

Remarks

As an aid to the Examiner, the preceding clean version of the claims shows all the claims in the application, including the claims not amended hereby.

Priority

The specification has been amended to clarify applicants' claim of foreign priority under 35 USC §119. The above application claimed priority of PCT Application No. PCT/EP99/02905 filed on 22 April 1999, which claimed priority of PCT Application No. PCT/BE98/00153 filed on 15 October 1998. A certified copy of German Application 198 07 145.0 will be furnished as soon as it is available.

Claims Status

The Examiner indicated in the Office Action Summary that claims 1-21 are rejected. Claims 13 and 14 have been canceled by this amendment and are no longer in consideration. Therefore, claims 1-12 and 15-21 are the claims now pending in the application. Claims 1, 6, 7 and 11 are the independent claims now pending in the application.

Claims Rejections – 35 U.S.C. § 102

Claims 1-5, 8, 17 and 20-21 are rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent 6,087,519 to Garnier (hereinafter "Garnier").

Garnier does not disclose an element coated with a polymer or prepolymer coating. There are four independent claims, claims 1, 6, 7 and 11, in consideration. In all of the independent claims, Applicants claim "a coating for the reinforcement element comprising a polymer." Garnier does not disclose this. For anticipation under 35 U.S.C. § 102, the reference must teach every aspect of the claimed invention. M.P.E.P. § 706.02(a).

Based on this, it is believed that the claims are distinguished over the prior art. Because claims 2-5, 8, 17 and 20-21 depend from and have all the limitations of

claims 1, 6, 7 or 11, claims 1-5, 8, 17 and 20-21 are believed to be distinguished from Garnier.

Claims 1-5, 8-10, 12, 13, 17 and 20-21 are rejected under 35 U.S.C. § 102(b) as being anticipated by JP 58-193134 (hereinafter "JP134").

JP134 discloses a steel cord reinforcement element with a liquid rubber containing -COOH or -OH functional groups. A liquid rubber is by definition a rubber having a low molecular weight. Because of the low molecular weight, the rubber is a liquid. Specifically, JP134 discloses a liquid rubber having molecular weights ranging between 10,000 and 30,000. In contrast, the Applicants' product has molecular weights ranging below 10,000 and, more specifically, approximately 3,000. JP134 discloses a coating that is achieved by immersion of a steel element in a pure liquid rubber bath. Because of the viscosity of the liquid rubber, thin layers cannot be achieved. The resulting thick layers give rise to "weak boundary layers," which is a disadvantage in the mechanical properties.

In contrast, Applicants claims 1, 6, 7 and 11 read "a coating for the reinforcement element comprising a polymer deposited from a solvent selected from the group consisting of an aqueous solvent, alcoholic solvent or organic solvent, and claim 11 reads "a coating for the reinforcement element comprising a prepolymer deposited from an aqueous solution." (emphasis added). The Applicants claim an adhesion promoting product, wherein the adhesion is between a metal surface and an elastomer which provides a superior resistance against aging, corrosion, dynamic loads and shear forces acting across the interface. As disclosed in the specification on page 18, the non-cured crosslinkable rubber or polymer is applied from solutions or solvents. This provides dense layers of equal thickness and especially thin layers of equal thickness.

For anticipation under 35 U.S.C. § 102, the reference must teach every aspect of the claimed invention. M.P.E.P. § 706.02(a). Based on this explanation, it is believed that the claims have been distinguished over the prior art.

Claims 1-3, 8, 12-13, 17 and 20-21 are rejected under 35 U.S.C. § 102(b) as being anticipated by FR 2271036 A (hereinafter "FR036").

FR036 discloses a coating for a steel reinforcement element with a first layer of an organosilane (i.e., an adhesion promoter), and a second layer of an organic RFL adhesive (i.e., an emulsion of a resorcinol-formaldehyde resin and rubber-containing latex, which is cured thereafter). The curing of RFL adhesive makes it impossible to get a smooth boundary layer between the coating and the rubber. The non-reactive rubber latex does not contribute to the bonding between the coating layer, and specifically, the rubber to be reinforced is only used to mechanically hold within the structure of the cross-linked. With respect to the metal bonding, the chemically reactive component is not covalently bonded to the rubber to be reinforced, and this is specifically what the Applicants' independent claims claim.

Claim 1 reads “[a] coated metal reinforcement element . . . bearing functional groups covalently bonded to the metal surface of said reinforcement element”; claim 6 reads “[a] coated metal reinforcement element . . . covalently bonded with the outwardly directed first functional groups of a mono-molecular layer of a bifunctional adhesion promoter intercalated between said metal and said coating and bound to said metal by its second functional groups”; claim 7 reads “[a] coated metal reinforcement element . . . covalently bonded with the outward directed first functional groups of multi-molecular layer of a bifunctional adhesion promoter intercalated between said metal and said coating and bound to said metal by its second functional groups”; and claim 11 reads “[a] coated metal reinforcement element . . . bearing functional groups covalently bonded to the metal surface of said reinforcement element.” Applicants’ claimed invention is unique and not found in the reference and does not come into being in hindsight.

Once again, FR036 does not disclose or teach the subject matter claimed by the Applicant. Rather, FR036 discloses that the chemically reactive component with respect to the metal bonding is not covalently bonded to the rubber to be reinforced. For anticipation under 35 U.S.C. § 102, the reference must teach every aspect of the claimed invention. M.P.E.P. § 706.02(a).

Claim Rejections – 35 U.S.C. § 103

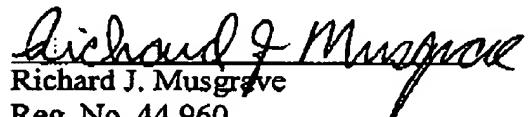
Claim 9 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Garnier in view of the “admitted prior art.” Claims 9-10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Garnier in view of United States Patent No. 3,793,130 to Marzocchi (hereinafter “Marzocchi”) or United States Patent No. 5,518,770 to Goliaszewski (hereinafter “Goliaszewski”) or JP134.

Garnier does not disclose an element coated with a polymer or prepolymer coating, whereas Applicants claim “a coating for the reinforcement element comprising a polymer.”

Garnier does not remotely teach or suggest a coating for the reinforcement element comprising a polymer.” Garnier teaches away from the Applicants’ claimed invention. The Applicants’ invention is unique and not found in the reference and does not come into being in hindsight. What is obvious is only that which can be deduced by the logical step-by-step reasoning process furnished by the prior art. It is an improper obviousness rejection, because there is no suggestion or expressed expectation of success in the prior art that would have led one to perform the experimentation in the first place.

In view of the above, it is submitted that this application is now in condition for allowance and an early notice of allowance is solicited.

Respectfully submitted,


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Version With Markings to Show Changes Made

Following is a marked-up version of the application with all changes shown by conventional comparison (underlining and bracketing).

In the Specification

Following is a marked-up version of the first paragraph on page 1, lines 4-6:

This application is a continuation of PCT Application No. PCT/EP99/02905 filed 22 April 1999 and which named the United States as a designated country. PCT Application PCT/EP99/02905 was published on 27 April 2000 as Publication No. WO 00/23505 and claims priority of PCT Application PCT/BE98/00153 filed on 15 October 1998.

Following is a marked-up version of the first paragraph on page 3, lines 1-9:

FR 2320974 A discloses a coating for a steel reinforcement element of a first layer of an organosilane and a second layer of an organic [REL] RFL adhesive, i.e. an aqueous emulsion of a [resorcinol-formaldehyd] resorcinol-formaldehyde resin and a rubber-containing latex, which is cured thereafter. This product can be used as a reinforcement element for rubber products. The curing of the [REL] RFL adhesive makes it impossible to get a smooth boundary layer between the coating and the rubber. Moreover the non-reactive rubber-latex is only held mechanically within the structure of the cross-linked resin and cannot contribute to the bonding between the coating layer and the rubber to be reinforced.

Following is a marked-up version of the two paragraphs on page 4, lines 9-21:

The adhesion promotor is advantageously utilized in a method for coating a metal surface with an adhesion promotor, comprising the preparation of a solution of the adhesion promotor and the dipping or painting of said metal surface with said solution, wherein the adhesion promotor is an [organosiloxan] organosiloxane of the general formula (I) given below, wherein X is a siloxane group, a [chiorosilane] chlorosilane group or a bromosilane group, and especially: -SH; -SiHCl₂; -SiH₂Cl; -Si(Cl)₃; -SiHBr₂; -SiH₂Br; -SiBr₃; -Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); COOH; COCl.

The adhesion promotor is pretreated before use in the following manner: a definite amount of water is added under stirring at elevated temperature, the amount being calculated to at least partially hydrolyse and to partially condense the [siloxan] siloxane. The solution is diluted with alcohol and immediately after a certain ripening period applied to said metal surface, thereby forming a dense mono- or multimolecular layer on the metal surface.

Following is a marked-up version of the paragraph on page 5, lines 4-8:

The metal surface can be treated to clean and/or at least parially oxidize the surface. Preferably the metal surface is treated with isopropanol (iPrOH), a mixture of isopropanol with water [(iPrOH-H₂O)] (iPrOH-H₂O), or diluted aqueous HCl. It is also possible to treat the surface with KOH or with a carbonate. All these measures can be used alone or in combination with each other.

Following is a marked-up version of the paragraph on page 7, lines 23-27:

The tensile strength of the steel wires or steel filaments ranges from 1500 [Mpa] MPa (1500 N/mm²) to over 4000 [Mpa] MPa and is mainly dependent upon the final diameter, the exact composition (amount of carbon + amount of micro-alloying components) and on the amount of final drawing reduction. These parameters can be tuned by the skilled practitioner in the field.

Following is a marked-up version of the paragraph on page 8, lines 4-13:

Possible matrix polymers or polymeric backbones may be, for example, thermoplastics, thermoplastic elastomers, and elastomers. Furthermore, the polymer can be, for example, a common thermoplastic polymer such as a thermoplastic polyolefin, olefinic rubber, polyurethane or blends thereof, an elastomeric polymer or copolymer or an at least partially elastomeric block copolymer, such as styrene butadiene rubber, [butylrubber] butyl rubber, acrylonitrile butadiene rubber, ethylene propylene [dien] diene copolymer, ethylene propylene copolymer, natural rubber, synthetic poly(isoprene) and chloroprene rubber. Moreover common prepolymers can be used that are compatible with and can be co-polymerized or crosslinked with the polymer to be reinforced.

Following is a marked-up version of the paragraph that begins on page 8, line 18, and ends on page 9, line 2:

The functionalities (X) of the functionalized polymer composition, if bound directly to the metal surface, include thiol groups, mercapto groups, silanes, mono-, di- or tri- alkoxy silanes, the alkyl being methyl, ethyl, propyl, especially:

-SH; -SiHCl₂; -SiH₂Cl; -Si(C1)₃; -SiHBr₂; -SiH₂Br; -SiBr₃;
-Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); -COOH; -COCl; -PO₃H₂, -SO₂H, their acid anhydride and their acid chloride groups;

an organometallic group of the formula -M(OR')_n or -M(Cl)_n, whereby M is a metal selected from the group comprising Al, Sn, B, Ti and V, n being the ligand number corresponding to the metal M;

a [phthalocyanin or a phthalonitril] phthalocyanine or a phthalonitrile group;

a monothiol or a monothiolate group;

and R' being alkyl, namely methyl, ethyl or propyl (branched or unbranched).

Following is a marked-up version of the paragraph on page 10, lines 12-16:

It is important to recognize that there may be a choice as to which partner carries which functional group, the functionalized polymer of the coating or the additional adhesion promotor. The list of possible combinations between X and Y groups includes: amine-epoxy, epoxy-silane, epoxy-acidic moieties, [chlorides] chlorides, and others.

Following is a marked-up version of the paragraph that begins on page 10, line 17, and ends on page 11, line 18:

The adhesion promotor optionally used for a better corrosion protection is a bifunctional compound of the general formula (I)



with

X: -SH; -SiHCl₂; -SiH₂Cl; -Si(Cl)₃; -SiHBr₂; -SiH₂Br; -SiBr₃; -Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); -COOH; -COCl, -PO₃H₂, -SO₂H, their acid anhydride and their acid chloride groups;

an organometallic group of the formula -M(OR')_n or -M(Cl)_n, whereby M is a metal selected from the group comprising Al, Sn, B, Ti and V, n being the ligand number corresponding to the metal M;

a phthalocyanin or a phthalonitril group;
a monothiol or a monothiolate group;
and R' being alkyl, namely methyl, ethyl or propyl (branched or unbranched);

R: -CH₂-; a -(CH₂)- chain, whereby 2 ≤ n ≤ 20 and whereby said chain may be unhalogenated, partially halogenated or perhalogenated and may contain aromatic or thiophen units, and whereby the chain and/or the units may comprise substituents selected from the group comprising:

-(CH₂)_iCH₃ with 0 ≤ i ≤ 5, -O(CH₂)_jCH₃, or -O(CF₂)_jCH₃ with 0 ≤ j ≤ 4, -CN and -NH₂; -CF₂-; -CH₂-CO-NH-CH₂-; CF₂-CO-NH-CF₂-; CH₂-CO-NH-CF₂-; CF₂-CO-NH-CH₂- and 0 ≤ n,m ≤ 16;

Y: NH₂, NHR', or NR'₂, or an unsaturated residue, especially an unsaturated terminal double or triple carbon-carbon bond; an acrylic or methacrylic acid group and its methyl or ethyl esters;

-CN; an activated carboxylic ester; an aldehyde group; an epoxide group;

-SH; -SiHCl₂; -SiH₂Cl; -Si(Cl)₃; -SiHBr₂; -SiH₂Br; -SiBr₃; -Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); -COOH; -COCl; or a functional group capable of forming a complex with at least one ingredient of the non-metallic medium.

[AR] Ar: an aromatic and/or heteroaromatic system, optionally substituted, for example according to the above cited list of substituents.

Following is a marked-up version of the paragraph on page 12, lines 14-18:

The metal surface can be treated to clean and/or at least partially oxidize the surface. Preferably the metal surface is treated with isopropanol (iPrOH), a mixture of isopropanol with water [(iPrOH-H₂O)] (iPrOH-H₂O), or diluted aqueous HCl. It is also possible to treat the surface with KOH or with a carbonate. All these measures can be used alone or in combination with one another.

Following is a marked-up version of the paragraph on page 12, lines 26-29:

Surprisingly, it is possible to achieve good results from the deposition in a one step procedure. For this purpose, a mixture of the two materials as cited above or a solution of both—the polymer of the coating and the [seperate] separate bifunctional adhesion promotor—is applied to the surface.

Following is a marked-up version of the paragraph on page 15, lines 28-30:

Steel cord

A steel cord coated by an [electzrolytically] electrolytically deposited Zn layer is used in this example.

Following is a marked-up version of the paragraph on page 16, lines 11-13:

The deposition of the polymer cation (material ‘B’) can be accomplished in one step together with an adhesion promoter (material “A”). [The following examples n and n+1 are given for the one step procedure.]

Following is a marked-up version of the paragraph on page 16, lines 21-29:

A first 10 cm³ aqueous solution of isopropanol, [iPrOH-H₂O] iPrOH-H₂O was realized, with [iPrOH-H₂O] iPrOH-H₂O proportions of 9:1. APS was added to this solution at 1% volume content. Material “B” was added to this solution. In this example, surface-modified polybutadiene was used, which is a powder of some 250 µm size particles. This product is derived by pulverizing commercial tires, and contains varying amounts of polybutadiene-costyrene, polybutadiene, natural rubber, carbon black, petroleum oil, zinc oxides and other additives. 400 mg of this powder is

added to the preceding solution of "A". The resulting mixture is a heterogeneous suspension, and is stirred.

Following is a marked-up version of the paragraph on page 18, lines 1-19:

1.) Adhesion to natural rubber:

The composition of the rubber is: natural rubber: 100 parts, carbon black N300: 60 parts per hundred rubber (phr), oil: 11 phr, zinc oxide: 5 phr, stearic acid: 1 phr, 6-ppd: 1 phr, sulphur: 2.5 phr, MBS: 0.6 phr.

Adhesion is quantified by the pull out force as per ASTM D2229. The embedded length is 25 mm. The vulcanization temperature was 150°C and vulcanization time was 20 minutes. The pull out speed is 100 mm/min, and the circle of the pull out clamp is 12.7 mm. Prior art stands for untreated zinc coated steel cord.

Pull out force (Newton)

[Prior art sample] <u>Prior art samples</u>	71
[(ditto)] <u>Prior art samples</u>	73
Example 5	453

2.) Adhesion to a conventional hose rubber compound:

Pull out force (Newton)

Prior art sample	73
Example 5	922

In the Claims

Following is a marked-up version of claims 1, 6, 7, 9, 11 and 15-20 with all changes shown by conventional comparison (underlining and bracketing).

1. (Once Amended) A coated metal reinforcement element for a polymeric or elastomeric material comprising: a metal reinforcement element having a metal surface; and a coating for the reinforcement element comprising a polymer deposited from a solvent selected from the group consisting of an aqueous [solution] solvent, alcoholic solvent or organic solvent and compatible with and co-polymerizable with said material to be reinforced, and bearing functional groups covalently bonded to the metal surface of said reinforcement element.

6. (Once Amended) [A coated metal reinforcement according to claim 1,]
A coated metal reinforcement element for a polymeric or elastomeric material comprising: a metal reinforcement element having a metal surface; and a coating for the reinforcement element comprising a polymer deposited from a solvent selected from the group consisting of an aqueous solvent, alcoholic solvent or organic solvent and compatible with and co-polymerizable with said material to be reinforced, and bearing functional groups covalently bonded [wherein said functional groups form covalent bonds] with the outward directed first functional groups of a mono-molecular layer of a bifunctional adhesion promoter intercalated between said metal and said coating and bound to said metal by its second functional groups.

7. (Once Amended) [A coated metal reinforcement according to claim 1,]
A coated metal reinforcement element for a polymeric or elastomeric material comprising: a metal reinforcement element having a metal surface; and a coating for the reinforcement element comprising a polymer deposited from a solvent selected from the group consisting of an aqueous solvent, alcoholic solvent or organic solvent and compatible with and co-polymerizable with said material to be reinforced, and

bearing functional groups covalently bonded [wherein said functional groups form covalent bonds] with the outward directed first functional groups of a multi-molecular layer of a bifunctional adhesion promoter intercalated between said metal and said coating and bound to said metal by its second functional groups.

9. (Once Amended) A coated metal reinforcement element according to claim 8, wherein said elongated steel element is coated with one or more metallic layers, [comprised of] an alloy selected from the group consisting of brass, bronze, zinc, zinc alloy, tin or tin alloy.

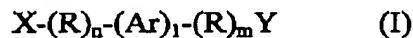
11. (Once Amended) [A coated metal reinforcement element according to claim 1,] A coated metal reinforcement element for a polymeric or elastomeric material comprising: a metal reinforcement element having a metal surface; and a coating for the reinforcement element comprising [wherein said coating comprises] a prepolymer deposited from an aqueous solution and compatible with and copolymerizable with said polymeric or elastomeric material to be reinforced, and bearing functional groups covalently bonding to the metal surface of said reinforcement element.

15. (Once Amended) A coated metal reinforcement element according to claim [14] 12, wherein the elastomeric block copolymer is selected from the group consisting of styrene butadiene rubber, butyl rubber, acrylonitrile butadiene rubber, ethylene propylene dien copolymer, ethylene propylene copolymer, natural rubber, synthetic poly(isoprene) and chloroprene rubber, or a functionalized non-cured rubber composition.

16. (Once Amended) A coated metal reinforcement element according to claim [15] 12, wherein the non-cured rubber composition is selected from the group consisting of a synthetic or natural poly(isoprene) or poly (butadiene) and includes common vulcanization additives and curing materials.

17. (Once Amended) A coated metal reinforcement element according to claim 1, wherein the [functionalities of the functionalized polymer] functional group include thiol groups, mercapto groups, silanes, amines, -SH; -SiHCl₂; -SiH₂Cl; -Si(Cl)₃; -SiHBr₂; -SiH₂Br; -SiBr₃; -Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); -COOH; -COCl, -PO₃H₂, -SO₂H, their acid anhydride and their acid chloride groups, organometallic groups of the formula -M(OR')_n or -M(Cl)_n, whereby M is a metal selected from the group [comprising] consisting of Al, Sn, B, Ti [and] or V, n being the ligand number corresponding to the metal M, [phthalocyanin or phthalonitril] phthalocyanine or phthalonitrile groups, monothiol or monothiolate groups, wherein R' is alkyl, [namely] methyl, ethyl or propyl [(branched or unbranched)] in case of a bonding directly to the metal surface; [and include thiol groups, mercapto groups, silanes, amines, -SH; -SiHCl₂; -SiH₂Cl; -Si(Cl)₃; -SiHBr₂; -SiH₂Br; -SiBr₃; -Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); -COOH; -COCl, -PO₃H₂, -SO₂H, their acid anhydride and their acid chloride groups, phthalocyanin or phthalonitril groups, monothiol or monothiolate groups] all these functional groups either as terminal groups or carried along the polymer backbone or as part of side chains, [as well as] further including epoxy groups carried along the polymer backbone.

18. (Once Amended) A coated metal reinforcement element according to claim 1, [wherein the] further including an adhesion promoter that is a bifunctional compound of the general formula (I)



with [x] X representing a group capable of reacting covalently at the metal surface,

R representing an organic spacer chain,

Ar representing an aromatic and/or heteroaromatic system,

Y representing a group capable of forming covalent bonds to [the functional groups of the] a group selected from polymer or prepolymer of the coating, and

$$0 \leq n,m \leq 16; 0 \leq l \leq 6.$$

19. (Once Amended) A coated metal reinforcement element according to claim [17] 18, wherein the [groups of] general formula (I) are as follows:

X: -SH; -SiHCl₂; -SiH₂Cl; -Si(Cl)₃; -SiHBr₂; -SiH₂Br; -SiBr₃; -Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); -COOH; -COCl; -PO₃H₂; -SO₂H, their acid anhydride and their acid chloride groups

an organometallic group of the formula -M(OR')_n or whereby M is a metal selected from the group [comprising] consisting of Al, Sn, B, Ti [and] or V, n being the ligand number corresponding to the metal M;

a [phthalocyanin or a phthalonitril] phthalocyanine or a phythalonitrile group;

a monothiol or a monothiolate group;

with R' being alkyl, namely methyl, ethyl or propyl [(branched or unbranched)],

Y: NH₂, NHR', or NR'₂, or an unsaturated residue, [especially] having an unsaturated terminal double or triple carbon-carbon bond; an acrylic or [methacrylic] methacrylic acid group and [ist] is methyl or ethyl esters;

-CN; an activated carboxylic ester; an aldehyde group; an epoxide group;

-SH; -SiHCl₂; -SiH₂Cl; -Si(Cl)₃; -SiHBr₂; -SiH₂Br; -SiBr₃; -Si(R'(Cl)₂); -Si(OR')₃; -Si(R'(OR')₂); -COOH; -COCl; or a functional group capable of forming a complex with at least one ingredient of [the] a non-metallic medium; [.]

R: -CH₂-; a -(CH₂)-chain, whereby 2 ≤ n ≤ 20 and whereby said chain may be unhalogenated, partially halogenated or perhalogenated and may contain aromatic or thiophen units, and whereby the chain and/or the units may comprise substituents selected from the group [comprising] consisting of:

-(CH₂)_iCH₃ with 0 ≤ i ≤ 5, -O(CH₂)_jCH₃, or -O(CF₂)_jCH₃ with 0 ≤ j ≤ 4, -CN and -NH₂; -CF₂-; -CH₂-CO-NH-CH₂-; -CF₂-CO-NH-CF₂-; -CH₂-CO-NH-CF₂-; CF₂- CO-NH-CH₂- [and] or 0 ≤ n,m ≤ 16,

AR: an aromatic and/or heteroaromatic system, [optionally] substituted, for [example according to the above cited list of] the substituents.

20. (Once Amended) A coated metal reinforcement element according to claim 1, including [an additional] a layer of [the] a polymeric or non-cured elastomeric composition on top of said coating for further reinforcement.